

NOAA SCIENTIFIC PUBLICATIONS REPORT MAY 8, 2017

HIGHLIGHTED ARTICLES

[Climate warming and changes in *Cyclotella sensu lato* in the Laurentian Great Lakes](#)

Limnology and Oceanography (3.66)

[The invasive tunicate *Didemnum vexillum* limits Atlantic sea scallop *Placopecten magellanicus* habitat on fishing grounds and closed areas of Georges Bank](#)

ICES Journal of Marine Science (2.801)

[Putting a value on injuries to natural assets: The BP oil spill](#)

Science (34.661)

[Cloud-atmospheric boundary layer-surface interactions on the Greenland Ice Sheet during the July 2012 extreme melt event](#)

Journal of Climate (4.31)

[Assessing recent declines in Upper Rio Grande River runoff efficiency from a paleoclimate perspective](#)

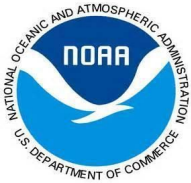
Geophysical Research Letters (4.212)

[Intensified dust storm activity and valley fever infection in the southwestern United States](#)

Geophysical Research Letters (4.212)

[The role of sulfur dioxide in stratospheric aerosol formation evaluated using in-situ measurements in the tropical lower stratosphere](#)

Geophysical Research Letters (4.212)



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ADDITIONAL ARTICLES

OAR Publications

[The impact of the AMO on multidecadal ENSO variability](#)

Geophysical Research Letters (4.212)

[Dynamical downscaling improves upon gridded precipitation products in the Sierra Nevada, California](#)

Climate Dynamics (4.708)

[Explosive processes during the 2015 eruption of Axial Seamount, as recorded by seafloor hydrophones](#)

Geochemistry, Geophysics, Geosystems (2.993)

[Role of atmospheric oxidation in recent methane growth](#)

Proceedings of the National Academy of Sciences (9.423)

[Are oligotypes meaningful ecological and phylogenetic units? A case study of microcystis in freshwater lakes](#)

Frontiers in Microbiology (4.165)

[Ambient sound at Challenger Deep, Mariana Trench](#)

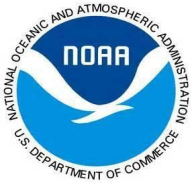
Oceanography (2.986)

[The compartment bag test \(CBT\) for enumerating fecal indicator bacteria: Basis for design and interpretation of results](#)

Science of the Total Environment (3.976)

[Evolution of the South Pacific helium plume over the past 3 decades](#)

Geochemistry, Geophysics, Geosystems (2.993)



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[Predicting spread of aquatic invasive species by lake currents](#)

Journal of Great Lakes Research (1.910)

[Meteorological influence on summertime baroclinic exchange in the Straits of Mackinac](#)

Journal of Geophysical Research: Oceans (3.44)

[Effects of display design on signal detection in flash flood forecasting](#)

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[NMFS Publications](#)

[Accounting for detection gaps when evaluating reef fish habitat use in an acoustic array](#)

Canadian Journal of Fisheries and Aquatic Sciences (2.44)

[Framework for increasing the science and management value of life stage monitoring networks for endangered Sacramento River Winter run Chinook salmon in California's regulated rivers and coastal ocean](#)

San Francisco Estuary and Watershed Science (0.57)

[Defining ecosystem thresholds for human activities and environmental pressures in the California Current](#)

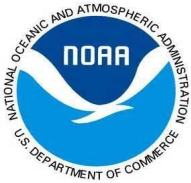
EcoSphere (2.287)

[Changes in spatial and temporal variability of prey affect functional connectivity of larval and juvenile cod](#)

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[Genotype-based estimates of local abundance and effective population size for Hector's dolphins](#)

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[Factors related to the decline and rebuilding of billfish stocks in the Atlantic and Indian oceans](#)

ICES Journal of Marine Sciences (2.801)

[Spatial patterns of Anchoveta \(*Engraulis ringens*\) eggs and larvae in relation to pCO₂ in the Peruvian upwelling system](#)

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[Spatial distribution and dive behavior of Gulf of Mexico Bryde's Whales: Potential risk for vessel strikes and fisheries interactions](#)

Endangered Species Research (1.325)

[Distribution, density, and size of migratory and non-migratory species of Sculpin in relation to barriers in Puget Sound lowland streams](#)

North American Journal of Fisheries Management (1.013)

[NWS Publications](#)

[High-resolution hail observations: implications for NWS warning operations](#)

Weather and Forecasting (1.972)

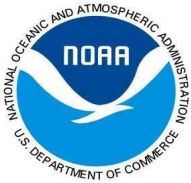
[A high-resolution aerial survey and radar analysis of quasi-linear convective system surface vortex damage paths from 31 August 2014](#)

Weather and Forecasting (1.972)

[NOS Publications](#)

[Benthic injury dose-response model for polychlorinated biphenyl-contaminated sediment using equilibrium partitioning](#)

Environmental Toxicology and Chemistry (2.763)



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OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

NOS

[Best practice for collecting onsite data to assess recreational use impacts from an oil spill](#)

Technical Memo NOS OR&R

HIGHLIGHTED ARTICLES

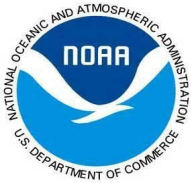
*Climate warming and changes in *Cyclotella sensu lato* in the Laurentian Great Lakes*

Limnology and Oceanography (3.66)

E. D. Reavie, G. V. Sgro, L. R. Estep, A. J. Bramburger, V. L. Shaw Chraïbi, R. W. Pillsbury, M. Cai, **C. A. Stow (OAR/GLERL)**, and A. Dove

- This study is the first to show evidence that biological changes in all of the pelagic Laurentian Great Lakes is associated with recent climate warming.
- Paleolimnological analysis of sediment cores indicated a changing diatom community that is consistent with climate change symptoms.

We present the first evidence of biological change in all of the pelagic Laurentian Great Lakes associated with recent climatic warming. We hypothesized that measured changes in lake temperature, and the resulting physical changes to water columns, were affecting diatom communities in the Great Lakes. A paleolimnological analysis of 10 sediment cores collected from deep locations throughout the Great Lakes basin indicates a recent (30–50 yr) reorganization of the diatom community to one characterized by elevated abundances of several species from the group *Cyclotella sensu lato*, coinciding with rising atmospheric and water temperatures. These *Cyclotella* increases are a probable mechanistic result of new physical regimes such as changing stratification depths and longer ice-free periods, and possibly water quality shifts. Efforts to understand the



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mechanisms of these changes are ongoing, but this compositional reorganization in primary producers could have important implications to Great Lakes food webs.

Publication date: March 17, 2017

Available online: <http://onlinelibrary.wiley.com/doi/10.1002/lno.10459/full>

The invasive tunicate Didemnum vexillum limits Atlantic sea scallop Placopecten magellanicus habitat on fishing grounds and closed areas of Georges Bank
ICES Journal of Marine Science (2.801)

K. A. Kaplan, **D. R. Hart** (NMFS/NEFSC), K. Hopkins, S. Gallager, A. York, R. Taylor, P. J. Sullivan

- This study indicates that the invasive tunicate *Didemnum vexillum* is less common in Closed Area II on Georges Bank than on an adjacent fished area, which suggests that fishing activity may contribute to the spread of the tunicate.
- It also indicates that sea scallop density is less in areas of high *Didemnum vexillum*, even when controlling for substrate and management status (open/closed).
- The results of this paper suggest that a reopening the portion of Closed Area II to scallop fishing may contribute to the spread of *Didemnum vexillum* into the closed area.

Marine invasive species can profoundly alter ecosystem processes by displacing native species and changing community structures. The invasive tunicate *Didemnum vexillum* was first found on the northern edge Georges Bank in 1998. It can form encrusting colonies on gravel substrates that are also a preferred habitat for a number of other invertebrates. In this study we used data collected via HabCam, a vessel-towed underwater imaging system, to investigate the distribution of *D. vexillum* and its relationship to other benthic invertebrates in a portion of Georges Bank that includes fishing grounds and an area protected from bottom fishing. This novel technology provides high resolution imaging of species distributions in areas of the benthic environment that were previously



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unobservable. We found that *D. vexillum* density is negatively correlated with the Atlantic sea scallop (*P. magellanicus*), barnacles (genus *Balanus*), the tube anemone (genus *Cerianthus*), the green sea urchin (*Strongylocentrotus dreobachiensis*), the globular sponge of the genus *Polymastia*, and bryozoans, but it positively correlated with *Cancer* spp. Crabs, the tube forming polychaete, *Filograna implexa*, and *Asterias* spp. sea stars. The hypothesis that *D. vexillum* restructures the invertebrate community is supported by principal components analysis, revealing it as a primary driver of variation in the community when present. Additionally, as consistent with previous studies, there is an effect of the closed area as compared to fishing grounds on the structure of the invertebrate community and the abundance of certain species. Principal components analysis revealed that bottom-fishing also appears to weaken clustering among species in the invertebrate community as compared to the community structure in the closed area. Biodiversity in high gravel sites, as measured by the Shannon diversity index, also declined with increasing *D. vexillum* percent cover, while the open and closed areas were not significantly different in their level of biodiversity. *Didemnum vexillum* appears to be the key driver of biodiversity decline when present, rather than other processes such as direct disturbance and extraction from dredging. This research evaluates ecological responses to the presence of an invasive tunicate and suggests that this invasive species is a major force in shaping the ecological interactions in invaded areas

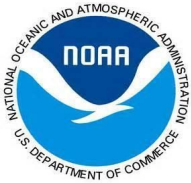
Acceptance date: April 16, 2017

Available online: no

Putting a value on injuries to natural assets: The BP oil spill

Science (34.661)

R. C. Bishop, K. J. Boyle, R. T. Carson, D. Chapman, W. M. Hanemann, B. Kanninen, R. J. Kopp, J. A. Krosnick, J. List, **N. Meade (NOS/ORR)**, R. Paterson, S. Presser, V. K. Smith, R. Tourangeau, M. Welsh, J. M. Wooldridge, M. DeBell, C. Donovan, M. Konopka, and N. Scherer



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- This study provides a novel approach to attaching a value to the natural assets damaged by the Gulf of Mexico 2010 oil spill.
- This study highlights the economic impact of ecosystem impacts despite these metrics not having a tangible market value.

When large-scale accidents cause catastrophic damage to natural or cultural resources, government and industry are faced with the challenge of assessing the extent of damages and the magnitude of restoration that is warranted. Although market transactions for privately owned assets provide information about how valuable they are to the people involved, the public services of natural assets are not exchanged on markets; thus, efforts to learn about people's values involve either untestable assumptions about how other things people do relate to these services or empirical estimates based on responses to stated-preference surveys. Valuation based on such surveys has been criticized because the respondents are not engaged in real transactions. Our research in the aftermath of the 2010 BP Deepwater Horizon oil spill addresses these criticisms using the first, nationally representative, stated-preference survey that tests whether responses are consistent with rational economic choices that are expected with real transactions. Our results confirm that the survey findings are consistent with economic decisions and would support investing at least \$17.2 billion to prevent such injuries in the future to the Gulf of Mexico's natural resources.

Publication date: April 21, 2017

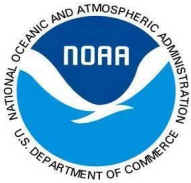
Available online: <http://science.sciencemag.org/content/sci/356/6335/253.full.pdf>

Cloud-atmospheric boundary layer-surface interactions on the Greenland Ice Sheet during the July 2012 extreme melt event

Journal of Climate (4.31)

A. Solomon, M. D. Shupe, and N. B. Miller (OAR/ESRL)

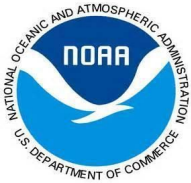
- This is the first study to show the relationship between cloud cover and extreme melting events of polar ice sheets.



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- At the time of the Greenland Ice Sheet extreme melt event, satellites detected stratocumulus clouds. These low-level cloud systems are consistently found in the area and play a unique role in regional climate, producing a surface warming effect over the central Greenland Ice Sheet even during periods of maximum incoming solar radiation.
- The findings of this modeling study indicate that beyond their direct radiative effect, these cloud systems impact the Greenland climate by modifying the properties of the ice sheet, the atmospheric structure, and the surface fluxes. Most notably, this study demonstrates that melting would not have occurred without preconditioning of the snowpack by cloud feedbacks previous to the extreme event, highlighting the sensitivity of the Greenland climate to the integrated impacts of clouds.

Regional model simulations of the 10–13 July 2012 extreme melt event over the Greenland Ice Sheet (GIS) are used to investigate how low-level liquid-bearing clouds impact surface energy fluxes, and therefore the energy available for melt. A sensitivity study in which the radiation code is modified so that cloud liquid and ice do not emit, absorb, or reflect radiation is used to identify cloud impacts beyond the cloud radiative effect. It is found that Arctic mixed-phase stratocumuli are not produced in the sensitivity experiment, highlighting that cloud radiative fluxes are required to maintain the clouds. A number of feedbacks are found that damp the warming effect of the clouds. Thin mixed-phase clouds increase the downward longwave fluxes by 100 W m^{-2} , but upward daytime surface longwave fluxes increase by 20 W m^{-2} (60 W m^{-2} at night) and net shortwave fluxes decrease by 40 W m^{-2} (partially due to a 0.05 increase in surface albedo), leaving only 40 W m^{-2} available for melt. This 40 W m^{-2} is distributed between the turbulent and conductive ground fluxes, so it is only at times of weak turbulent fluxes (i.e., at night or during melt) that this energy goes into the conductive ground flux, providing energy for melt. From these results it is concluded that it is the integrated impact of the clouds over the diurnal cycle (the preconditioning of the snowpack



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by the clouds at night) that made melt possible during this 3-day period. These findings are extended to understand the pattern of melt observed over the GIS.

Publication date: May 1, 2017

Available online: <http://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-16-0071.1>

Assessing recent declines in Upper Rio Grande River runoff efficiency from a paleoclimate perspective

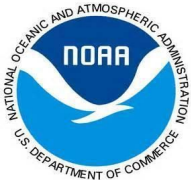
Geophysical Research Letters (4.212)

F. Lehner, **E. Wahl (NESDIS/NCEI)**, A. W. Wood, D. B. Blatchford, D. Llewellyn

- The decreasing runoff efficiency trend from 1986-2015 in the Upper Rio Grande River basin is unprecedented in the last 445 years.
- Very low runoff ratios are 2.5 to 3 times more likely when temperatures are above normal than when they are below normal.
- The trend arises primarily from natural variability but runoff sensitivity to temperature implies further declines should warming continue.

Recent decades have seen strong trends in hydroclimate over the American Southwest, with major river basins such as the Rio Grande exhibiting intermittent drought and declining runoff efficiencies. The extent to which these observed trends are exceptional has implications for current water management and seasonal streamflow forecasting practices. We present a new reconstruction of runoff ratio for the Upper Rio Grande basin back to 1571 CE, which provides evidence that the declining trend in runoff ratio from the 1980s to present-day is unprecedented in context of the last 445 years. Though runoff ratio is found to vary primarily in proportion to precipitation, the reconstructions suggest a secondary influence of temperature. In years of low precipitation, very low runoff ratios are made 2.5-3 times more likely by high temperatures. This temperature sensitivity appears to have strengthened in recent decades, implying future water management vulnerability should recent warming trends in the region continue.

Publication date: April 5, 2017



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Available online: <http://onlinelibrary.wiley.com/doi/10.1002/2017GL073253/epdf>

Intensified dust storm activity and valley fever infection in the southwestern United States

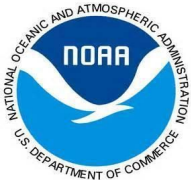
Geophysical Research Letters (4.212)

D. Q. Tong, J. X. Wang, T. E. Gill, H. Lei (OAR/ARL), B. Wang

- The authors reconstructed long-term dust climatology in the western United States, based on a comprehensive dust identification method and continuous aerosol observations from the Interagency Monitoring of Protected Visual Environments network.
- Researchers reported direct evidence of rapid intensification of dust storm activity over American deserts in the past decades (1988-2011).
- This dust trend is associated with large-scale variations of sea surface temperature in the Pacific Ocean, with the strongest correlation with the Pacific Decadal Oscillation (PDO).
- Researchers also determined that the frequency of dust storms is correlated with Valley fever incidences, with a coefficient (r) comparable to or stronger than that with other factors believed to control the disease in two endemic centers (Maricopa and Pima County, Arizona).

Climate models have consistently projected a drying trend in the southwestern United States, aiding speculation of increasing dust storms in this region.

Long-term climatology is essential to documenting the dust trend and its response to climate variability. We have reconstructed long-term dust climatology in the western United States, based on a comprehensive dust identification method and continuous aerosol observations from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. We report here direct evidence of rapid intensification of dust storm activity over American deserts in the past decades (1988-2011), in contrast to reported decreasing trends in Asia and Africa. The frequency of windblown dust storms has increased 240% from decades of 1990s to 2000s. This dust trend is associated with large-scale variations of sea



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surface temperature in the Pacific Ocean, with the strongest correlation with the Pacific Decadal Oscillation (PDO). We further investigate the relationship between dust and Valley fever, a fast-rising infectious disease caused by inhaling soil-dwelling fungus (*Coccidioides immitis* and *C. posadasii*) in the southwestern United States. The frequency of dust storms is found to be correlated with Valley fever incidences, with a coefficient (r) comparable to or stronger than that with other factors believed to control the disease in two endemic centers (Maricopa and Pima County, Arizona).

Publication date : May 10, 2017

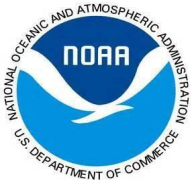
Available online: <http://onlinelibrary.wiley.com/doi/10.1002/2017GL073524/pdf>

The role of sulfur dioxide in stratospheric aerosol formation evaluated using in-situ measurements in the tropical lower stratosphere

Geophysical Research Letters (4.212)

A. W. Rollins, T. D. Thornberry, L. A. Watts, P. Yu, K. H. Rosenlof, M. Mills, E. Baumann, F. R. Giorgetta, T. V. Bui, M. Höpfner, K. A. Walker, C. Boone, P. F. Bernath, P. R. Colarco, P. A. Newman, D. W. Fahey, and R. S. Gao
(OAR/ESRL)

- Stratospheric aerosols are a variable component of the Earth's reflectance and an important component of the Earth's radiative balance. Stratospheric aerosols also provide an environment that can efficiently destroy stratospheric ozone.
- Because stratospheric aerosols' lifetimes are on the order of 100 times longer than tropospheric aerosols, the relatively small sources of stratospheric aerosols are disproportionately significant for climate regulation. Some proposals suggest direct injection of SO₂ into the lower stratosphere could be used to mitigate global warming.
- Understanding the present-day chemistry and dynamics that control the distribution of aerosols in the stratosphere is the key to predicting the effectiveness and consequences of climate intervention scenarios.



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In 2015, CSD scientists took the first in-situ measurements of sulfur dioxide (SO₂) in the tropical upper tropopause and lower stratosphere as part of NASA's "mini-mission" Volcano-plume Investigation Readiness and Gas-phase and Aerosol Sulfur (VIRGAS). The role of SO₂ from the troposphere in maintaining background stratospheric aerosols has been debated for decades - without the benefit of in-situ measurements of SO₂ at the tropical tropopause to inform the issue. This paper clarifies the role of SO₂ in maintaining stratospheric aerosols by using new in-situ SO₂ measurements to evaluate climate models and satellite retrievals. We then use the observed tropical tropopause SO₂ mixing ratios to estimate the global flux of SO₂ across the tropical tropopause.

Publication date: May 3, 2017

Available online: <http://onlinelibrary.wiley.com/doi/10.1002/2017GL072754/full>

ADDITIONAL ARTICLES

OAR Publications

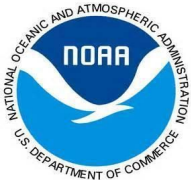
The impact of the AMO on multidecadal ENSO variability

Geophysical Research Letters (4.212)

A. F. Z. Levine, M. J. McPhaden (OAR-PMEL), and D. M. W. Frierson

- The observed relationship between ENSO and the annual cycle over decades cannot be captured by a change to only ENSO or the annual cycle
- In response to forcing from the AMO, the observed changes to ENSO and the annual cycle are consistent with the two being linked
- A coupled model experiment confirms that the AMO impacts ENSO both directly and through changes to the annual cycle

Multidecadal shifts in ENSO variability have been observed, but it is unclear if this variability is just a random variation in the ENSO cycle or whether it is forced by other modes of climate variability. Here we show a strong influence of the Atlantic on the multidecadal variability of ENSO. The Atlantic Multidecadal Oscillation (AMO) is the dominant mode of multidecadal SST variability in the Atlantic Ocean. Changes in AMO-related tropical Atlantic SSTs are known to force



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changes in the Walker Circulation in the tropical Pacific Ocean. We show that these changes to the Walker Circulation modify ENSO stability on both annual and multidecadal timescales leading to a distinctive pattern of multidecadal ENSO variability that we find in observations, ocean reanalyses and conceptual and coupled model experiments.

Publication date: April 17, 2017

Available online: onlinelibrary.wiley.com/doi/10.1002/2017GL072524/full

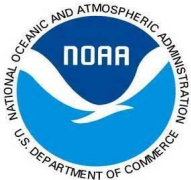
Dynamical downscaling improves upon gridded precipitation products in the Sierra Nevada, California

Climate Dynamics (4.708)

Mimi Hughes(OAR-ESRL/CIRES), Jessica D. Lundquist, and Brian Henn

- Statistically gridded precipitation datasets differ from observations leading to biases in model forecasts
- The results of this study suggest a path forward for improving precipitation estimates in complex terrain, using either dynamical estimates produced from dynamical downscalings, or perhaps hybrid techniques that merge the benefits of dynamical techniques with reduced computational cost.

Uncertainties in gridded and regional climate estimates of precipitation are large at high elevations, where observations are sparse and spatial variability is substantial. We explore these uncertainties for water year 2008 across California's Sierra Nevada in 10 datasets: six regional climate downscalings generated using the Weather, Research, and Forecast (WRF) model at convection-permitting resolution with differing lateral boundary conditions and microphysical parameterizations, and four gauge-based, interpolation-gridded precipitation datasets. Precipitation from these 10 datasets is evaluated against 95 snow pillows and a precipitation dataset inferred from stream gauges using a Bayesian inference method. During water year 2008, the gridded datasets tend to underestimate frozen precipitation on the windward slope of the Sierra Nevada, particularly in the vicinity of Yosemite National Park. The WRF simulations with single-moment microphysics tend to



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overestimate precipitation throughout much of the region, whereas the WRF simulations with double-moment microphysics tend to better agree with both the snow pillows and inferred precipitation estimates, although they somewhat overestimate the windward/leeward precipitation contrast in the northern Sierra Nevada. WRF simulations, in particular those with single-moment microphysics, better distinguish spatial patterns of wet-versus-dry pillows and watersheds over the water year than the gridded estimates. Our results suggest treating gauge-based datasets as ‘truth’ may give a misleading representation of model accuracy, since these gauge-based datasets often have issues of their own.

Publication date: April 21, 2017

Available online: <https://link.springer.com/article/10.1007/s00382-017-3631-z>

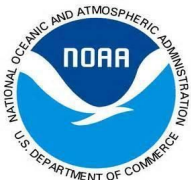
Explosive processes during the 2015 eruption of Axial Seamount, as recorded by seafloor hydrophones

Geochemistry, Geophysics, Geosystems (2.993)

Caplan-Auerbach, **R.P. Dziak (OAR-PMEL)**, **J. Haxel (OAR-PMEL/CIMRS)**, D.R. Bohnenstiehl, and C. Garcia

- A full eruption cycle at Axial seamount was captured by a network of seafloor hydrophones
- Signals recorded by seafloor hydrophones represent different eruptive mechanisms
- A signal interpreted as Hawaiian-style explosive degassing and ash generation is identifiable in hydroacoustic data

Following the installation of the Ocean Observatories Initiative cabled array, the 2015 eruption of Axial Seamount, Juan de Fuca ridge, became the first submarine eruption to be captured in real time by seafloor seismic and acoustic instruments. This eruption also marked the first instance where the entire eruption cycle of a submarine volcano, from the previous eruption in 2011 to the end of the month-long 2015 event, was monitored continuously using autonomous ocean bottom hydrophones. Impulsive sounds associated with explosive lava-water



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interactions are identified within hydrophone records during both eruptions. Explosions within the caldera are acoustically distinguishable from those occurring in association with north rift lava flows erupting in 2015. Acoustic data also record a series of broadband diffuse events, occurring in the waning phase of the eruption, and are interpreted as submarine Hawaiian explosions. This transition from gas-poor to gas-rich eruptive activity coincides with an increase in water temperature within the caldera and with a decrease in the rate of deflation. The last recorded diffuse events coincide with the end of the eruption, represented by the onset of inflation. All the observed explosion signals couple strongly into the water-column, and only weakly into the solid Earth, demonstrating the importance of hydroacoustic observations as a complement to seismic and geodetic studies of submarine eruptions.

Available online:

<http://onlinelibrary.wiley.com/doi/10.1002/2016GC006734/full>

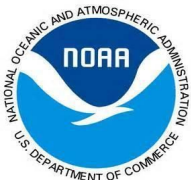
Publication date: April 12, 2017

Role of atmospheric oxidation in recent methane growth

Proceedings of the National Academy of Sciences (9.423)

M. Rigbya, **S. A. Montzka (OAR/ESRL)**, R. G. Prinn, J. W. C. White, D. Young, S. O'Doherty, M. F. Lunt, A. L. Ganesan, A. J. Manning, P. G. Simmonds, P. K. Salameh, C. M. Harth, J. Muhle, R. F. Weiss, P. J. Fraser, L. P. Steele, P. B. Krummel, A. McCulloch, S. Park

- Methane, the second most important greenhouse gas, has varied markedly in its atmospheric growth rate and the cause of these fluctuations remains poorly understood.
- In this study, we show that changes in the major methane sink, the hydroxyl radical, have likely played a substantial role in the global methane growth rate.
- This work has significant implications for our understanding of the methane budget, which is important if we are to better predict future changes in this



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potent greenhouse gas and effectively mitigate enhanced radiative forcing caused by anthropogenic emissions.

The growth in global methane (CH_4) concentration, which had been ongoing since the industrial revolution, stalled around the year 2000 before resuming globally in 2007. We evaluate the role of the hydroxyl radical (OH), the major CH_4 sink, in the recent CH_4 growth. We also examine the influence of systematic uncertainties in OH concentrations on CH_4 emissions inferred from atmospheric observations. We use observations of 1,1,1-trichloroethane (CH_3CCl_3), which is lost primarily through reaction with OH , to estimate OH levels as well as CH_3CCl_3 emissions, which have uncertainty that previously limited the accuracy of OH estimates. We find a 64–70% probability that a decline in OH has contributed to the post-2007 methane rise. Our median solution suggests that CH_4 emissions increased relatively steadily during the late 1990s and early 2000s, after which growth was more modest. This solution obviates the need for a sudden statistically significant change in total CH_4 emissions around the year 2007 to explain the atmospheric observations and can explain some of the decline in the atmospheric $^{13}\text{CH}_4/^{12}\text{CH}_4$ ratio and the recent growth in C_2H_6 . Our approach indicates that significant OH -related uncertainties in the CH_4 budget remain, and we find that it is not possible to implicate, with a high degree of confidence, rapid global CH_4 emissions changes as the primary driver of recent trends when our inferred OH trends and these uncertainties are considered.

Publication date: April 17, 2017

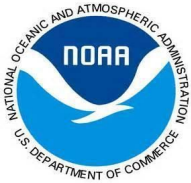
Available online:

<http://www.pnas.org/content/early/2017/04/11/1616426114.full.pdf>

Are oligotypes meaningful ecological and phylogenetic units? A case study of microcystis in freshwater lakes

Frontiers in Microbiology (4.165)

Berry, M. A., J. D. White, **T. W. DAVIS**, S. Jain, **T. H. JOHENG**
EN (**OAR/GLERL**), G. J. Dick, O. Sarnelle, and V. J. Denef.



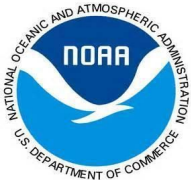
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- Rapid assessment of toxic populations of HABs is critical for developing models that better predict toxicity.
- In Lake Erie, shifts in *Microcystis* oligotypes corresponded to spatial nutrient gradients and temporal transitions in bloom toxicity.
- While oligotypes are useful for distinguishing closely related strains, they are not able to determine toxicity but may be useful to looking at shifts in other environmental drivers and HAB populations.

Oligotyping is a computational method used to increase the resolution of marker gene microbiome studies. Although oligotyping can distinguish highly similar sequence variants, the resulting units are not necessarily phylogenetically and ecologically informative due to limitations of the selected marker gene. In this perspective, we examine how oligotyping data is interpreted in recent literature, and we illustrate some of the method's constraints with a case study of the harmful bloom-forming cyanobacterium *Microcystis*. We identified three *Microcystis* oligotypes from a western Lake Erie bacterial community 16S rRNA gene (V4 region) survey that had previously clustered into one OTU. We found the same three oligotypes and two additional sequence variants in 46 *Microcystis* cultures isolated from Michigan inland lakes spanning a trophic gradient. In Lake Erie, shifts in *Microcystis* oligotypes corresponded to spatial nutrient gradients and temporal transitions in bloom toxicity. In the cultures, *Microcystis* oligotypes showed preferential distributions for different trophic states, but genomic data revealed that the oligotypes identified in Lake Erie did not correspond to toxin gene presence. Thus, oligotypes could not be used for inferring toxic ecotypes. Most strikingly, *Microcystis* oligotypes were not monophyletic. Our study supports the utility of oligotyping for distinguishing sequence types along certain ecological features, while it stresses that 16S rRNA gene sequence types may not reflect ecologically or phylogenetically cohesive populations. Therefore, we recommend that studies employing oligotyping or related tools consider these caveats during data interpretation.

Publication date: March 8, 2017



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Available online:

<http://journal.frontiersin.org/article/10.3389/fmicb.2017.00365/full>

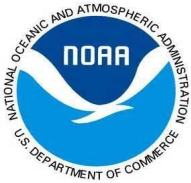
Ambient sound at Challenger Deep, Mariana Trench

Oceanography (2.986)

R. P. Dziak, J. H. Haxel, H. Matsumoto, T.-K. Lau, S. Heimlich, S. Nieukirk, **D. K. Mellinger**, **J. Osse**, C. Meinig, N. Delich, and **S. Stalin (OAR/PMEL)**

- The authors present ambient noise recorded in 2015 at the Challenger Deep in the Mariana Trench.
- Observed sounds included earthquake T phases, whale and dolphin vocalizations, ship propeller noise, airguns, active sonar, and Category 4 typhoon.
- Our study indicates that Challenger Deep, the ultimate hadal (>6,000 m) environment, can be relatively quiet but is not as acoustically isolated as previously thought, and weather-related surface processes can influence the soundscape in the deepest parts of the ocean.

We present a record of ambient sound obtained using a unique deep-ocean instrument package and mooring that was successfully deployed in 2015 at Challenger Deep in the Mariana Trench. The 45 m long mooring contained a hydrophone and an RBR™ pressure-temperature sensor. The hydrophone recorded continuously for 24 days at a 32 kHz sample rate. The pressure logger recorded a maximum pressure of 11,161.4 decibars, corresponding to a depth of 10,829.7 m, where actual anchor depth was 10,854.7 m. Observed sound sources included earthquake acoustic signals (T phases), baleen and odontocete cetacean vocalizations, ship propeller sounds, airguns, active sonar, and the passing of a Category 4 typhoon. Overall, Challenger Deep sound levels in the ship traffic band (20–100 Hz) can be as high as noise levels caused by moderate shipping, which is likely due to persistent commercial and military ship traffic in the region. Challenger Deep sound levels due to sea surface wind/waves (500 Hz to 1 kHz band) are as high as sea state 2, but can also be very low, equivalent to sea state 0.



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To our knowledge, this is the first long-term (multiday to week) broadband sound record, and only the fifth in situ measurement of depth, ever made at Challenger Deep. Our study indicates that Challenger Deep, the ultimate hadal (>6,000 m) environment, can be relatively quiet but is not as acoustically isolated as previously thought, and weather-related surface processes can influence the soundscape in the deepest parts of the ocean.

Publication date: April 11, 2017

Available online: <https://doi.org/10.5670/oceanog.2017.240>

The compartment bag test (CBT) for enumerating fecal indicator bacteria: Basis for design and interpretation of results

Science of the Total Environment (3.976)

A. D. Gronewold (OAR/GLERL), M. D. Sobsey, K. McMahan

- The compartment bag test (CBT), a currently used drinking water quality testing method around the world, now has a statistical basis for results interpretation as part of this project.
- Recommendations for interpreting results, including procedures for estimating quantiles of the fecal indicator bacteria, are presented.

For the past several years, the compartment bag test (CBT) has been employed in water quality monitoring and public health protection around the world. To date, however, the statistical basis for the design and recommended procedures for enumerating fecal indicator bacteria (FIB) concentrations from CBT results have not been formally documented. Here, we provide that documentation following protocols for communicating the evolution of similar water quality testing procedures. We begin with an overview of the statistical theory behind the CBT, followed by a description of how that theory was applied to determine an optimal CBT design. We then provide recommendations for interpreting CBT results, including procedures for estimating quantiles of the FIB concentration probability distribution, and the confidence of compliance with recognized water quality guidelines. We synthesize these values in custom user-oriented 'look-up' tables



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similar to those developed for other FIB water quality testing methods. Modified versions of our tables are currently distributed commercially as part of the CBT testing kit.

Publication date: February 27, 2017

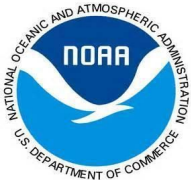
Available online: <https://10.1016/j.scitotenv.2017.02.055>

Evolution of the South Pacific helium plume over the past 3 decades
Geochemistry, Geophysics, Geosystems (2.993)

J. E. Lupton (OAR/PMEL) and W. J. Jenkins

- A 26-year comparison of the East Pacific Rise's helium plume was conducted from overlapping stations of the 2013 GEOTRACES Eastern Pacific Zonal Transect and 1987 Helios Expedition.
- Many areas remained unchanged between expeditions and an estimated average westward transport of $\sim 0.4 \text{ cm s}^{-1}$ from "aging" the plume was similar to the 1987 RAFOS float estimate of $\sim 0.3 \text{ cm s}^{-1}$; however, there was a decrease in plume intensity at 120°W due to intrusion of a different water mass.
- 0.04°C of excess heat was recorded, similar to that of mature hydrothermal vents.

The recent GEOTRACES Eastern Pacific Zonal Transect in 2013 crossed the East Pacific Rise at 15°S following the same track as the 1987 Helios Expedition along the core of the mid-depth helium plume that spreads westward from the East Pacific Rise (EPR) axis. The fact that several stations were co-located with the earlier Helios stations has allowed a detailed comparison of the changes in the helium plume over the intervening 26 years. While the plume in many areas is unchanged, there is a marked decrease in plume intensity at longitude 120°W in the 2013 data which was not present in 1987. Recent radioisotope measurements along the plume track suggest that this decrease is due to the intrusion of a different water mass into the plume, rather than a modulation of hydrothermal input on the EPR axis. Analysis of GEOTRACES hydrographic data shows excess heat present in the plume up to 0.04°C , corresponding to a $3\text{He}/\text{heat}$ ratio of $\sim 2.5 \times 10^{-18} \text{ mol}$



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J-1, similar to that found in mature hydrothermal vents. RAFOS floats deployed in 1987 indicate an average westward transport of $\sim 0.3 \text{ cm s}^{-1}$ at 2500 m depth in the off-axis plume, in agreement with recent estimates of $\sim 0.4 \text{ cm s}^{-1}$ based on “aging” of the plume from $^{227}\text{Ac}/^3\text{He}$ ratios.

Publication date: May 4, 2017

Available online: <http://onlinelibrary.wiley.com/doi/10.1002/2017GC006848/full>

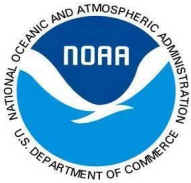
Predicting spread of aquatic invasive species by lake currents

Journal of Great Lakes Research (1.910)

D. Beletsky , **R. Beletsky (OAR/OARO)**, **E. S. Rutherford (OAR/GLERL)**, J. L. Sieracki, J. M. Bossenbroek, W. L. Chadderton, M. E. Wittmann, G. M. Annis and D. M. Lodge

- A hydrodynamics model was used to predict spread of 2 invasive species larvae by lake currents in Lake Michigan and Lake Erie.
- In each lake, veligers of golden mussel were found to spread farther from rivers, ports and offshore release sites than would Eurasian ruffe larvae because of differences in species spawning time and stage duration.

Knowledge of aquatic invasive species (AIS) dispersal is important to inform surveillance and management efforts to slow the spread of established invaders. We studied potential dispersal of invasive Eurasian ruffe *Gymnocephalus cernua* and golden mussel *Limnoperna fortunei* larvae in Lakes Michigan and Erie using a three-dimensional particle transport model. Ruffe is currently in Lake Superior and northern Lake Michigan, while *Limnoperna* has not yet invaded the Great Lakes. We predicted larval transport during several spawning seasons (individual years) from several major tributaries and ports that are most prone to invasion because of their significant recreational and commercial usage. Depending on release location, larvae traveled distances ranging from $< 1 \text{ km}$ to tens of kilometers (in some cases over 100–200 km, depending on species) during 2–3 weeks of drift time. Dispersal distances from nearshore locations (i.e. rivers and ports) were smaller than from offshore deballasting locations near ports. *Limnoperna* dispersal distances were



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larger than ruffe due to stronger seasonal currents and longer drift period. Settlement areas resulting from offshore releases were larger than for nearshore releases, and larger for *Limnoperna* than for ruffe. Model results compared favorably to observed spread of ruffe and *Dreissena* spp. mussels in Lake Michigan. Our modeling effort suggests that larval advection by lake currents is an important AIS dispersal mechanism in the Great Lakes. It also emphasizes the importance of effective surveillance programs that maximize early detection of new introductions before lake current dispersal obviates containment and prevention of spread and impacts.

Publication date: March 1, 2017

Available online:

<http://www.sciencedirect.com/science/article/pii/S0380133017300291>

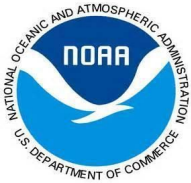
Meteorological influence on summertime baroclinic exchange in the Straits of Mackinac

Journal of Geophysical Research: Oceans (3.44)

E. J. ANDERSON (OAR/GLERL) and D. J. Schwab

- Flow in the Straits of Mackinac is the combination of a barotropic mode (e.g. winter time) driven by regional meteorological conditions and a baroclinic mode (e.g. summertime) driven by local meteorological conditions.
- This seasonal variability is driven by the onset of thermal stratification, which enables the shift from regional- to local- meteorological influence.
- These mechanisms are critical to transport through the Straits (e.g. oil spill).

Straits flows can impose a complex hydrodynamic environment with high seasonal variability and significant impacts to nearby water bodies. In the Straits of Mackinac, exchange flow between Lake Michigan and Lake Huron influences water quality and ecological processes, as well as the transport of any contaminants released in or near the straits. Although previous work has shown that a Helmholtz mode is responsible for the barotropic flow oscillations in the straits, baroclinic



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effects impose opposite surface and subsurface flows during the summer months. In this study, we use observations of currents and water temperatures from instruments deployed in the straits to validate a hydrodynamic model of the combined Lake Michigan-Huron system and then use the model results to investigate the baroclinic flow and determine the forcing mechanisms that drive exchange flow in the Straits of Mackinac. Analysis shows that although the Helmholtz mode drives a 3 day oscillation throughout the year, thermal stratification in the summer establishes a bidirectional flow that is governed by a shift from regional-scale to local-scale meteorological conditions. These results detail the seasonal variability in the straits, including the barotropic and baroclinic contributions to exchange flow and the influence of local atmospheric forcing on transport through the Straits of Mackinac.

Publication date: March 16, 2017

Available online:

<http://onlinelibrary.wiley.com/doi/10.1002/2016JC012255/abstract>

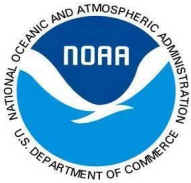
Effects of display design on signal detection in flash flood forecasting

International Journal of Human-Computer Studies (1.476)

Elizabeth M. Argyle, **Jonathan J. Gourley (OAR)**, Chen Ling, Randa L. Shehab, Ziho Kang

- Discusses the Flooded Locations and Simulated Hydrographs project, a set of models intended for flash flood forecasting.
- Evaluates the effects on user performance of two data aggregation methods for a flash flood visualization.
- Demonstrates that signal detection in the tool is related to display method, threat level, and scale of visual distractors.

A sample of 30 participants viewed a series of stimuli created from Flooded Locations and Simulated Hydrographs (FLASH) images - a set of models intended for flash flood forecasting and participants were asked to judge whether or not they predicted significant or insignificant amounts of flash flooding. Analyses revealed that choice of aggregation method did affect probability of detection. Additional



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visual indicators such as geographic scale of the stimuli and threat level affected the odds of interpreting the model predictions correctly as well as congruence in responses between national and local scale model outputs.

Publication date : March 2017

Available online: <http://www.sciencedirect.com/science/journal/10715819/99>

NMFS Publications

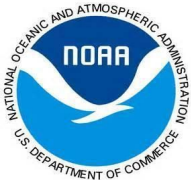
Accounting for detection gaps when evaluating reef fish habitat use in an acoustic array

Canadian Journal of Fisheries and Aquatic Sciences (2.44)

N. A. Farmer (NMFS/SERO), J. S. Ault

- Describes improved method for identifying preferential habitat use for fish tracked by passive acoustic array
- Red and black groupers preferred high relief reef habitats
- Mutton and yellowtail snappers preferred low-relief contiguous reef habitats

Understanding the relationship between “habitats” and the distribution of fishes is critical to effective survey design and spatial management. Determining reef fish habitat utilization patterns from passive acoustic arrays is challenging because: (1) habitat classifications must be meaningful to the species; (2) the array must contain the species’ home range; and, (3) the probability of detection may differ amongst habitats within the array. We conducted a multi-year tracking study in the marine protected areas (MPAs) of Dry Tortugas, Florida, using a calibrated passive acoustic array deployed over habitats classified by type (reef, rubble, sand), rugosity (high, medium, low relief), and patchiness (contiguous, spur-and-groove, isolated). Our design controlled for differences between individuals, diel and edge effects, and detection gaps resulting from the non-linear relationship between acoustic tag detection probabilities as a function of distance from the receiver. We found red and black groupers preferred high relief reef habitats, whereas mutton and yellowtail snappers preferred low-relief contiguous reef habitats. By



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identifying critical habitats for exploited species, our analysis may facilitate more efficient fishery-independent sampling and MPA designs.

Publication date: April 17, 2017

Available online:

<http://www.nrcresearchpress.com/doi/abs/10.1139/cjfas-2016-0494#.WQyLOPnyUk>

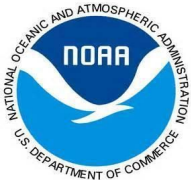
Framework for increasing the science and management value of life stage monitoring networks for endangered Sacramento River Winter run Chinook salmon in California's regulated rivers and coastal ocean

San Francisco Estuary and Watershed Science (0.57)

R. C. Johnson (NMFS/SWFSC), S. Windell, P. L. Brandes, J. L. Conrad, J. Ferguson, P. A. L. Goertler, B. N. Harvey, **J. Heublein (NMFS/WCR)**, J. A. Israel, D. W. Kratville, J. E. Kirsch, R. W. Perry, J. Pisciotto, W. R. Poytress, K. Reece, and **B. G. Swart (NMFS/WCR)**

- Makes consensus recommendations from multiple agencies on improvements to monitoring for endangered winter-run Chinook salmon (NOAA Species in the Spotlight).
- Recommendations likely incorporated into management-relevant compliance documents (currently in Adaptive Management Plan for California Water Fix).

A robust monitoring network that provides quantitative information about the status of imperiled species at key life stages and geographic locations over time is fundamental for the sustainable management of fisheries resources. For anadromous species, management actions in one geographic domain can substantially affect abundance of subsequent life stages that span broad geographic regions. For endangered Sacramento River Winter-run Chinook salmon (SRWRC; *Oncorhynchus tshawytscha*) in the California Central Valley, a monitoring network that provides data needed to diagnose when (life stage) and where (geographic domain) chronic or episodic reductions in SRWRC cohorts only partially exists.



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The strongest quantitative data exists in the Upper Sacramento River, where abundance estimates are generated for both adult spawners and emigrating juveniles. However, once SRWRC leave the upper river, our knowledge of their identity, abundance, and condition diminishes despite the juvenile monitoring enterprise. This conclusion was reached by comparing current monitoring activities to conceptual models developed for each life stage and geographic region of the life cycle that identified relevant metrics for SRWRC. Results suggest that quantitative metrics that include abundance, movement, survival, life history diversity, and condition at multiple life stages are necessary to inform how water management, hatcheries, harvest, and habitat restoration influence salmon population dynamics. To strengthen the value of data generated from the existing monitoring network, six system-wide recommended actions were identified: 1) incorporate genetic run identification; 2) develop juvenile abundance estimates; 3) collect data for life history diversity metrics at multiple life stages; 4) expand and enhance real-time fish survival and movement monitoring; 5) collect fish condition data; and 6) provide timely public access to monitoring data in Open Data formats. Examples of how each recommendation can address specific management issues are provided to illustrate how updated technologies can enhance the existing monitoring network to provide quantitative data on SRWRC.

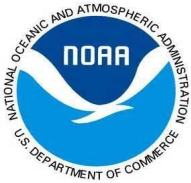
Acceptance date: April 21, 2017

Available online: no

Defining ecosystem thresholds for human activities and environmental pressures in the California Current

EcoSphere (2.287)

J. F. Samhuri (NMFS/NWFSC), S. Andrews, G. Fay, **C. J. Harvey (NMFS/NWFSC)**, **E. L. Hazen (NMFS/SWFSC)**, S. M. Hennessey, **K. Holsman (NMFS/AKFSC)**, **M. E. Hunsicker (NMFS/NWFSC)**, S. I. Large, K. N. Marshall, A. C. Stier, J. C. Tam, **S. G. Zador (NMFS/AKFSC)**

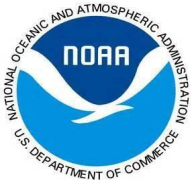


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- Examination of multiple IEA indicators and identification of non-linear relationships has identified some thresholds that may be useful for management
- This is an important example of how ESRs and the IEA process can be used to examine potential ecosystem thresholds.

The oceans are changing more rapidly than ever before. Unprecedented climatic variability is interacting with unmistakable long-term trends, all against a backdrop of intensifying human activities. What remains unclear, however, is how to evaluate whether conditions have changed sufficiently to provoke major responses of species, habitats, and communities. We developed a framework based on multimodel inference to define ecosystem-based thresholds for human and environmental pressures in the California Current marine ecosystem. To demonstrate how to apply the framework, we explored two decades of data using gradient forest and generalized additive model (GAM) analyses, screening for nonlinearities and potential threshold responses of ecosystem states ($n=9$) across environmental ($n=6$) and human ($n=10$) pressures. These analyses identified the existence of threshold responses of five ecosystem states to four environmental and two human pressures. Both methods agreed on threshold relationships in two cases: (i) the winter copepod anomaly and benthic modification, and (ii) sea lion pup production and the summer mode of the Pacific Decadal Oscillation (PDO). Considered collectively, however, these alternative analytical approaches imply that as many as five of the nine ecosystem states may exhibit threshold changes in response to negative PDO values in the summer (copepods, scavengers, groundfish, and marine mammals). This result is consistent with the idea that the influence of the PDO extends across multiple trophic levels, but extends current knowledge by defining the nonlinear nature of these responses. This research provides a new way to interpret changes in the intensities of human and environmental pressures as they relate to the ecological integrity of the California Current ecosystem. These insights can be used to make more informed assessments



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of when and under what conditions intervention, preparation, and mitigation may enhance progress toward ecosystem-based management goals.

Acceptance date: April 19, 2017

Available online: No

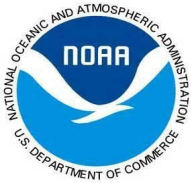
Changes in spatial and temporal variability of prey affect functional connectivity of larval and juvenile cod

ICES Journal of Marine Science (2.626)

R. G. Lough, E. A. Broughton (NMFS/NEFSC), T. Kristiansen

- A warming ocean may reduce the importance of the cold-water copepod *Pseudocalanus* spp, the preferred prey of larval cod on Georges Bank.
- Increasing abundance of the warm-water copepod *Centropages* spp. can bridge the size-nutritional continuum between the smaller *Pseudocalanus* spp. and the larger copepodids of *Calanus finmarchicus* for the pelagic juveniles.
- Specific predator-prey information presented is needed for a more complete and integrative understanding the dynamics of fish stocks, and ultimately ecosystems functioning.

Changes in structural connectivity as it can affect functional connectivity, the biological and behavioral responses of an organism, has been examined here over two contrasting years when the spatial distribution of larval and juvenile cod and their prey shifted from the flank to the crest on Georges Bank. New data on the gut contents of pelagic juvenile cod are compared to known prey distributions, potential growth and how climate warming can change connectivity in this region. *Centropages* spp. was the most important prey for pelagic juveniles, especially in June 1987 when they had high abundance on the crest and were dominant in the cod stomachs. In June 1986, copepod abundance was low where the juveniles were distributed along the flank. The potential growth of juvenile cod was greater in June 1987, consistent with the higher abundance of *Centropages* spp., and with higher recruitment survival, compared to June 1986. Annual changes in the spatial



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distribution of cod early life stages within the environment of cold or warm years, can have different impacts on their growth and survival. Whereas the small copepods, *Pseudocalanus* spp., are primary prey for cod larvae and very abundant in cold years, larger copepods, *Calanus finmarchicus* and *Centropages* spp., are important prey for the pelagic juveniles and the latter species can have a high impact in warm years on the coast. The different spatial structure during cold or warm years provides an explanation why different year classes respond differently to environmental change. Depending on the presence or absence of specific prey, the functional connectivity response changes pathways that determine the growth and survival of early life stages and ultimately a role in recruitment.

Acceptance date: April 23, 2017

Available online: no.

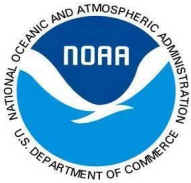
Genotype-based estimates of local abundance and effective population size for Hector's dolphins

Biological Conservation (3.762)

R. M. Hamner, R. Constantine, R. Mattlin, **R. S. Waples (NMFS/NWFSC)**, C. S. Baker

- This study used genetic data from biopsy samples to estimate both census size (N) and effective population size (N_e) in Hector's dolphin, an endangered species in New Zealand.
- Results confirm the precarious status of this population but also show that non-lethal genetic methods can provide valuable information of management relevance.

Conservation and management decisions for wild populations are often based on demographic estimates of abundance (N), and less frequently, on genetic estimates of effective population size (N_e). We used genotype-based methods to estimate both parameters from the same set of biopsy samples, while also providing information on the geographic closure of a local population of Hector's dolphins in Cloudy Bay, New Zealand. The assumption of closure in Cloudy Bay



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was supported by the lack of genetic differentiation between the two survey years and the absence of any genetically detectable migrants. Using recapture analysis based on genotype identifications, we estimated the abundance of individuals age 1+ (N^{1+}) to be 269 (95% CL=233-319, CV=0.12). This was similar to, but more precise than, $N^e=230$ (95% CL=130-407, CV=0.30) from the more traditional analysis using contemporaneously collected photo-identifications. The N^e of the parental generation was 191 (95% CL=23-362), and the resulting N^e/N^{1+} of 0.71 was in reasonable agreement with species of similar life history characteristics. Although N^e was below the recommended threshold (500, recently increased to =1000) thought to be necessary to preserve long-term evolutionary potential in perpetuity, genetic connectivity with neighboring populations on a generational time scale is likely to mitigate the negative effects of low local N^e . Our work demonstrates the breadth of management-relevant information (e.g., N , N^e , sex ratio, genetic diversity, and connectivity to neighboring populations) that can be obtained from a genotype-based analysis, and how conservation implications can change when demographic and genetic population size are considered along with connectivity.

Acceptance date: April 17, 2017

Available online: no

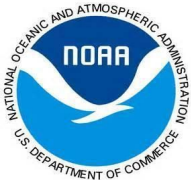
Factors related to the decline and rebuilding of billfish stocks in the Atlantic and Indian oceans

ICES Journal of Marine Sciences (2.801)

R. Sharma, M. Pons, S. Martin, L. Kell, J. Walter, M. Lauretta, and M. Schirripa (NMFS/SEFSC)

- The paper quantifies threshold limits on longline effort in the Atlantic and Indian Oceans.
- In addition the paper analyzes economic data and hypothesizes rebuilding in relation to economies.

The paper examines factors related to the decline and rebuilding of billfish stocks in the Atlantic and Indian oceans. Longline effort has declined over the last 10–15



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years in both oceans. This decline in fishing pressure has led to the recovery of some stocks, but some species that are caught incidentally in industrial longline fisheries remain overexploited. Using a simple moving average technique on fishing mortality trajectories, we estimated a threshold effort size of 240 million hooks for the Atlantic Ocean and 364 million hooks for the Indian Ocean where stocks start experiencing overfishing. In addition, we highlight differences in the economic characteristics of the major fleets catching billfish in the two oceans and discuss how this may be associated with differences in management, enforcement, and stock rebuilding.

Acceptance date: April 25, 2017

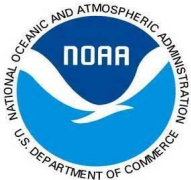
Spatial patterns of Anchoveta (Engraulis ringens) eggs and larvae in relation to pCO₂ in the Peruvian upwelling system

Proceedings of the Royal Society B. (5.68)

S. G. Shen, **A. R. Thompson**, **J. Correa (NMFS/SWFSC)**, P. Fietzek, P. Ayon, D. M. Checkley

- It appears that near South America, Anchovetta larvae mortality is much higher in waters with high CO₂ waters than lower CO₂ waters.
- Since CO₂ is predicted to increase with climate change, enhanced larval mortality may hurt the population in the future.
- Catch limits in the future may need to be adjusted to accommodate higher larval mortality and lower recruitment if CO₂ continues to rise.

Large and productive fisheries occur in regions experiencing or projected to experience ocean acidification. Anchoveta (*Engraulis ringens*) constitute the world's largest single-species fishery and live in one of the ocean's highest pCO₂ regions. We investigated the relationship of the distribution and abundance of Anchoveta eggs and larvae to natural gradients in pCO₂ in the Peruvian upwelling system. Eggs and larvae, zooplankton, and data on temperature, salinity, chlorophyll a and pCO₂ were collected during a cruise off Peru in 2013. pCO₂ ranged from 167-1392 μ atm and explained variability in egg presence, an index of



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spawning habitat. Zooplankton abundance explained variability in the abundance of small larvae. Within the main spawning and larva habitats (6-10°S), eggs were found in cool, low salinity, and both extremely low ($< 200 \mu\text{atm}$) and high ($> 900 \mu\text{atm}$) pCO_2 waters, and larvae were collected in warmer, higher salinity, and moderate (400-600 μatm) pCO_2 waters. The most likely explanation for these results is that Anchoveta preferentially spawned at high pCO_2 but these eggs had lower survival. Enhanced understanding of the influence of pCO_2 on Anchoveta spawning and larva mortality, together with pCO_2 measurements, may enable predictions of ocean acidification effects on Anchoveta and inform adaptive fisheries management.

Publication date: April 28, 2017

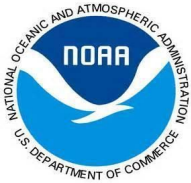
Available online: no

Spatial distribution and dive behavior of Gulf of Mexico Bryde's Whales: Potential risk for vessel strikes and fisheries interactions

Endangered Species Research (1.325)

M. S. Soldevilla, J. A. Hildebrand, K. E. Frasier, L. A. Dias, A. Martinez, K. D. Mullin, P. E. Rosel, and L. P. Garrison (NMFS/SEFSC)

- Results from more than 20 years of ship surveys and one electronic tag indicate this very small population of Gulf of Mexico Bryde's whales mainly occurs in a restricted location along the northeastern Gulf of Mexico shelf break, and the tagged whale exhibited behaviors which may put the population at risk of collisions with vessels or entanglement in pelagic or bottom longline gear, particularly the reef fish bottom longline fishery.
- Moderate levels of commercial shipping traffic and pelagic and bottom longline activity occur within the primary habitat, and mitigation measures may be warranted given the population estimate of 33 individuals cannot withstand anthropogenic impacts.
- Potential mitigation measures are suggested, including geospatial management, such as developing an MPA, expansion of the De Soto Canyon



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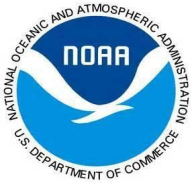
closed areas to cover larger area and more activities, shipping traffic re-routing or speed reductions, increased fishery observer coverage within the Gulf of Mexico Bryde's whale habitat, and potential gear modifications if fisheries interactions are observed.

Bryde's whales (*Balaenoptera edeni*) are the only resident baleen whale species in the Gulf of Mexico (GoMx), where they are extremely rare, have a restricted distribution, and represent a unique evolutionary lineage. The reasons for the restricted distribution and small population size are unknown, but high levels of industrial activity in the GoMx may be a major factor. We evaluated the geospatial overlap of GoMx Bryde's whales with two industries known to impact baleen whale species: commercial shipping and commercial fisheries. We further evaluate potential for impacts by examining the first dive behavior data collected from a kinematic tag attached to a GoMx Bryde's whale for three days. Vessel traffic and fishery effort are low in GoMx Bryde's whale habitat compared to the rest of the northern GoMx, but several shipping lanes transit through the habitat, and the reef fish bottom longline fishery has considerable effort within the habitat. The tagged whale exhibited diel diving behavior with diurnal deep dives and foraging lunges at or near the seafloor, and shallow nocturnal diving with 88% of its night time spent near the surface within the draught depths of most large commercial vessels. Given the location of commercial shipping traffic in their habitat, ship strikes may pose a threat to this population if whales commonly spend time near the surface especially at night. Also, if bottom or near-bottom feeding is a normal feeding strategy for these whales, there is potential for gear-entanglements with bottom longline gear. Managing these threats may improve population recovery.

Acceptance date: April 20, 2017

Available online: <https://doi.org/10.3354/esr00834>

Distribution, density, and size of migratory and non-migratory species of Sculpin in relation to barriers in Puget Sound lowland streams



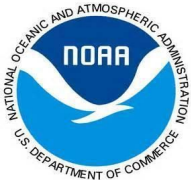
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North American Journal of Fisheries Management (1.013)

R. A. Tabor, F. T. Waterstrat, D. W. Lantz, H. B. Berge, **M. Liermann**
(NMFS/NWFSC)

- The authors examined the effects of barriers on populations of migratory (Coastrange Sculpin *C. aleuticus* and Prickly Sculpin *C. asper*) and non-migratory sculpin (Riffle Sculpin *C. gulosus*, Shorthead Sculpin *C. confusus*, and Torrent Sculpin *C. rhotheus*).
- They accomplished this by comparing sculpin populations upstream and downstream of barriers in 19 Puget Sound, Washington lowland streams.
- Overall, barriers appear to have a strong effect on the distribution of migratory sculpin and indirectly on the distribution non-migratory sculpin and need to be taken into account when assessing fish communities in Puget Sound lowland streams.

We examined the effects of barriers on populations of migratory (Coastrange Sculpin *C. aleuticus* and Prickly Sculpin *C. asper*) and non-migratory sculpin (Riffle Sculpin *C. gulosus*, Shorthead Sculpin *C. confusus*, and Torrent Sculpin *C. rhotheus*). Because migratory sculpin have pelagic larvae that drift downstream to calm waters and juveniles and adults migrate upstream, barriers can alter their distribution. We compared sculpin populations upstream and downstream of barriers in 19 Puget Sound, Washington lowland streams. All streams had populations of Coastrange Sculpin or Prickly Sculpin or both in stream reaches downstream of the barrier. In 8 of the 19 streams studied, at least one species of non-migratory sculpin was also present. Non-migratory sculpin can complete their life cycle in a relatively small area and barriers are less likely to affect their distribution but they may be indirectly affected by barriers through interactions with migratory sculpin. In all streams examined, the density of migratory sculpin immediately upstream of the barrier was lower than immediately downstream of the barrier. In 12 of the 19 streams, migratory sculpin were not present immediately upstream of the barrier. The few migratory sculpin collected upstream of the barrier were considerably larger than those collected downstream



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of the barrier. In most streams with non-migratory sculpin populations, non-migratory sculpin were rare downstream of the barrier and abundant upstream of the barrier. We also documented the longitudinal distribution of sculpin in one stream without a barrier. Migratory sculpin species dominated the lower stream reaches and were gradually replaced by non-migratory sculpin species in more upstream reaches. The abundance of migratory sculpin appears to be largely constrained by their ability to migrate upstream, whereas the abundance of non-migratory sculpin is likely influenced by interactions with migratory sculpin species. Overall, barriers appear to have a strong effect on the distribution of migratory sculpin and indirectly on the distribution non-migratory sculpin and need to be taken into account when assessing fish communities in Puget Sound lowland streams.

Publication date : Spring 2017

Available online: no

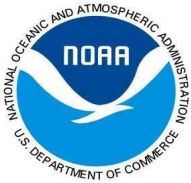
NWS Publications

High-Resolution Hail Observations: Implications for NWS Warning Operations Weather and Forecasting (1.972)

S. F. Blair (NWS/EAX), J. M. Laflin (NWS/EAX), D. E. Cavanaugh (NWS/LZK), K. J. Sanders, S. R. Currens, J. I. Pullin, D. T. Cooper, D. R. Deroche, J. W. Leighton, R. V. Fritchie, M. J. Mezeul II, B. T. Goudeau, S. J. Kreller, J. J. Bosco, C. M. Kelly, H. M. Mallinson

- Hail reports received at NWS offices are frequently underestimated in size, which may influence NWS warnings and lead to smaller hail size forecasts than radar data suggest.

A field research campaign, the Hail Spatial and Temporal Observing Network Effort (HailSTONE), was designed to obtain physical high-resolution hail measurements at the ground associated with convective storms to help answer several operational challenges that remain unsatisfied through public storm reports. Field phases occurred over a 5-year period, yielding hail measurements from 73 severe thunderstorms (hail diameter ≥ 1 in; ≥ 2.54 cm). These data provide



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unprecedented insight into the hail-fall character of each storm, and afford a baseline to explore the representativeness of the climatological hail database and hail forecasts in NWS warning products. Based upon the full analysis of HailSTONE observations, hail sizes recorded in Storm Data, as well as hail size forecasts in NWS warnings, frequently underestimated the maximum diameter hail-fall occurring at the surface. NWS hail forecasts were generally conservative in size, and at least partially calibrated to incoming hail reports. Storm mode played a notable role in determining the potential range of maximum hail size during the lifespan of each storm. Supercells overwhelmingly produced the largest hail diameters, with smaller maximum hail sizes observed as convection became progressively less organized. Warning forecasters may leverage a storm mode hail size forecast philosophy, in conjunction with other radar-based hail detection techniques, to better anticipate and forecast hail sizes during convective warning episodes.

Publication date: April 11, 2017

Available online: <http://dx.doi.org/10.1175/WAF-D-16-0203.1>

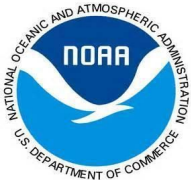
A high-resolution aerial survey and radar analysis of quasi-linear convective system surface vortex damage paths from 31 August 2014

Weather and Forecasting (1.972)

K. D. Skow, C. Cogil (NWS/CR)

- Study addresses a thunderstorm complex that generated 35 circulations which were later classified as tornadoes.
- Authors recommend that tornado warnings may not be practical for this number of small-scale, weak tornadic circulations.

On the evening of 31 August 2014, a powerful quasi-linear convective system (QLCS) impacted much of Iowa. In the weeks following the event, the entire path of the QLCS was imaged at ~1-m resolution using aerial photography through the National Agriculture Imagery Program. The predominantly flat, mature agricultural land cover of central Iowa provided an excellent medium on which to



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document all scales of wind phenomena. The high-resolution aerial data, in combination with recent spatial, temporal, and polarimetric upgrades to the Weather Surveillance Radar-1988 Doppler (WSR-88D) network, offers an extraordinary glimpse into the quantity, evolution, and scale of surface vortices generated throughout the entire lifespan of a QLCS. One-hundred-and-eleven damage tracks were cataloged along the storm's 350-km path, ranging in length from 130 m to nearly 18 km. This study classified 35 of these circulations as tornadoes using a series of tests that weighed track characteristics and radar data. Unusual features, such as a tornado merger and multiple instances of tornadoes occluding behind the QLCS surface cold pool, are examined. Possible genesis mechanisms and National Weather Service operational implications are also discussed. A new, behavioral-based approach for identifying a tornadic debris signature (TDS) is also presented that may be better suited for QLCS and other non-supercellular/weak tornadoes. Twelve TDSs were cataloged on 31 August 2014 using this methodology at ranges up to 90 km from the Des Moines, Iowa WSR-88D (KMDX).

Publication date: April 2017

Available online: <http://journals.ametsoc.org/doi/pdf/10.1175/WAF-D-16-0136.1>

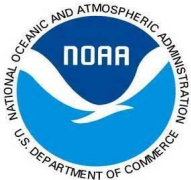
NOS Publications

Benthic Injury Dose-response Model for Polychlorinated Biphenyl-contaminated Sediment Using Equilibrium Partitioning

Environmental Toxicology and Chemistry (2.763)

K. F. Finkelstein, N. Beckvar (NOS ORR), and T. Dillon

- The study developed a sediment polychlorinated biphenyl (PCB) dose–response model based on benthic invertebrate effects to PCBs.
- To create the model the authors used an equilibrium partitioning (EqP) approach to generate predicted PCB sediment effect concentrations (largely Aroclor 1254) associated with a gradient of toxic effects in benthic organisms from effects observed in aquatic toxicity studies.

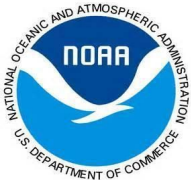


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- These models were used to generate “lookup” tables reporting percent injury in benthic biota for a range of Aroclor-specific sediment concentrations.

The study goal was to develop a sediment polychlorinated biphenyl (PCB) dose–response model based on benthic invertebrate effects to PCBs. The authors used an equilibrium partitioning (EqP) approach to generate predicted PCB sediment effect concentrations (largely Aroclor 1254) associated with a gradient of toxic effects in benthic organisms from effects observed in aquatic toxicity studies. The present study differs from all other EqP collective sediment investigations in that the authors examined a common dose–response gradient of effects for PCBs rather than a single, protective value. The authors reviewed the chronic aquatic toxicity literature to identify measured aqueous PCB concentrations and associated benthic invertebrate effects. The authors control-normalized the aquatic toxic effect data and expressed results from various studies as a common metric, percent injury. Then, they calculated organic carbon–normalized sediment PCB concentrations (mg/kg organic carbon) from the aqueous PCB toxicity data set using EqP theory based on the US Environmental Protection Agency’s (EPIWEB 4.1) derivation of the water–organic carbon partition coefficient (KOC). Lastly, the authors constructed a nonlinear dose–response numerical model for these synoptic sediment PCB concentrations and biological effects: $Y = 100 / (1 + 10^{([\log EC_{50} - \log X] \cdot \text{Hill slope})})$ (EC_{50} = median effective concentration). These models were used to generate “lookup” tables reporting percent injury in benthic biota for a range of Aroclor-specific sediment concentrations. For example, the model using the EPIWEB KOC estimate predicts mean benthic injury of 23.3%, 46.0%, 70.6%, 87.1%, and 95% for hypothetical sediment concentrations of 1 mg/kg, 2 mg/kg, 4 mg/kg, 8 mg/kg, and 16 mg/kg dry weight of Aroclor 1254, respectively (at 1% organic carbon). The authors recommend the model presented for screening but suggest, when possible, determining a site-specific KOC that, along with the tables and equations, allows users to create their own protective dose–response sediment concentration.

Publication date : December 13, 2016



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Available online: <http://onlinelibrary.wiley.com/doi/10.1002/etc.3662/abstract>

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

NOS PUBLICATIONS

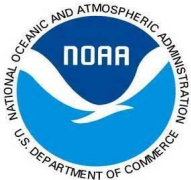
White paper on Gulf of Mexico mercury fate and transport: Applying scientific research to reduce the risk from mercury in Gulf of Mexico seafood

NCCOS Technical Memorandum

D. Evans (NOS/NCCOS), M. Cohen (NOS/NCCOS), C. Hammerschmidt, W. Landing, D. Rumbold, J. Simons, and S. Wolfe

- Mitigation approaches will need to recognize the complexity of the mercury pathways, and the need to incorporate the spatial, temporal, and ecological variability of mercury concentrations among water, sediments, and biota and the demographic variability among consumers.
- Mitigation will need to be implemented at the appropriate spatial and temporal scale to achieve the desired results.
- Each of the four approaches (source reduction, consumption advisories, landscape modification, and fisheries management) can be appropriate for a specific situation, which will require an integrated strategy.

Consumption of marine fish is the greatest source of mercury exposure to United States residents. Consumers along the Gulf of Mexico coast are at enhanced risk because of their high levels of seafood consumption and the likelihood that many species of Gulf of Mexico (Gulf) fish have higher levels of mercury than the same species harvested on other coasts. The Authors developed a whitepaper that broadly outlines our current knowledge of mercury in the Gulf of Mexico. The Authors make recommendations of research needs and approaches that, if undertaken, would provide coastal managers with the ability to better ameliorate the toxicological risks of mercury to residents of the Gulf of Mexico, and help fulfill mandated requirements to improve impaired water bodies which EPA and the states typically engage through the Total Maximum Daily Load (TMDL)



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process. Recommendations for scientific research to achieve risk reduction goals include: identification of at risk groups; identification and quantification of locales where methylmercury enters the food web and processes leading to mercury biomagnification by seafood species; identification of locales where methylmercury is produced from inorganic mercury in the Gulf of Mexico; quantification of inorganic mercury and methylmercury inputs to the Gulf, its estuaries, and open waters via atmospheric deposition, watershed deliveries, and oceanic deliveries from the Atlantic Ocean; predicting and measuring the relationships between mercury inputs to the Gulf and local, regional, national, and global emission sources; and develop mitigation strategies.

Publication date: December 2014

Available online:

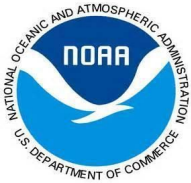
<http://www.arl.noaa.gov/documents/reports/NCCOS%20TM-192.pdf>

Best Practice for Collecting Onsite Data to Assess Recreational Use Impacts from an Oil Spill

Eric Horsch , Michael Welsh , Jason Price (Editors: Adam Domanski, **Norman Meade (NOS OR&R)**, Jason Murray)

Technical Memo NOS OR&R

On April 20, 2010, 41 miles off the coast of Louisiana in the Gulf of Mexico, an explosion and subsequent fire aboard the Deepwater Horizon drilling rig led to the largest offshore oil spill in United States history. During the following three and one-half months, oil flowed out of the well, through the waters of the gulf, and onto beaches, marshes, and other types of shoreline from Texas to Florida. Federal and State natural resource trustees engaged in a natural resource damage assessment (NRDA), as provided for under the federal Oil Pollution Act of 1990, to document the environmental harm and ultimately restore the Gulf of Mexico and compensate the U.S. public for the interim losses caused by the spill. Trustees have led NRDAs over the years on numerous other oil spills, but never at a level of effort, intensity, nor scale demanded by the Deepwater Horizon (DWH) incident.

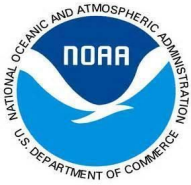


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An integral component of most NRDA is the assessment of lost recreational use opportunities to the public. For the Exxon Valdez (1989), American Trader (1990), Tampa Bay (1993), Chalk Point (2000), Buzzards Bay (2003), and Cosco Busan (2007) spills (among others), trustees have used data on recreational use to estimate lost value and implement restoration projects to compensate the public. The DWH incident provided an unprecedented challenge to develop and implement procedures to survey recreational users of natural resources over a vast area and for an extended period. Shortly after the spill, NOAA, in coordination with other state and federal trustees, implemented a study that utilized aerial overflights and hundreds of infield interviewers, photo counters, data entry staff, programmers, economists, survey research experts and statisticians. During the three-year study, staff members processed more than 497,000 aerial photographs and infield teams interviewed over 128,000 individuals at recreational sites along the Gulf from Louisiana to Florida. This study was designed to be rigorous, comprehensive, and defensible from a litigation standpoint. An external audit performed on the data collection process, after-the fact, showed that the intensive quality assurance and quality control procedures in place delivered a dataset with a statistically zero error rate. This study, along with the rest of the NRDA, helped secure the largest monetary settlement ever reached with a single entity in the United States. The settlement funds are being used in the restoration of the injured natural resources of the Gulf of Mexico to the benefit of generations to come. The DWH infield study serves as an impressive model for measuring recreational use. This procedures manual builds off the processes and lessons learned from the DWH NRDA and is designed to serve as a guide for any public agency or private organization interested in measuring recreational use at shoreline areas, fishing sites, and boat ramps. Our goal is to provide a guide that if followed, can provide reliable and defensible estimates that can inform policy, planning, or NRDA case decisions.

Publication date : March, 2017



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Available online:

ftp://ftp.library.noaa.gov/noaa_documents.lib/NOS/ORR/TM_NOS_ORR/TM_NOS-ORR_54.pdf